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ABSTRACT

Quality circles (QCs) have been considered one of the most promising approaches to improving American workers' productivity. The differences of quality circle effectiveness between active QCs (N=36) and inactive QCs (N=17) in a 3-year period were examined in a quasi-experimental field study. The dependent variables examined were the amount of middle-management involvement, the number of people per quality circle (QC size), the attendance rate at QC meetings, and several measures of their problem-solving activities. The results suggested that active QCs had a significantly higher level of involvement from the middle management than had inactive QCs. Active QCs had more circle members and had a significantly higher attendance rate at QC meetings than had inactive QCs. Further, active QCs had a significantly lower rate of failure in their problem-solving process than had inactive QCs. It was also found that for active QCs, their QC tenure was negatively correlated with the QC size, and was positively correlated with the number of projects attempted, the number of projects dropped, and the number of projects completed. For inactive QCs, the attendance rate at AC meetings was negatively correlated with the number of projects completed and their QC tenure was negatively correlated with the rate of failure. (Author/NB)

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The Survival of Quality Circles: An Examination of the Major In-Process Differences Between Active and Inactive Quality Circles

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Abstract

The differences of quality circle (QC) effectiveness between active QCs (N = 36) and inactive QCs (N = 17) in a three-year period were examined in a quasi-experimental field study. The dependent variables examined in the present study were the amount of middle-management involvement, the number of people per quality circle (QC size), the attendance rate at QC meetings, and several measures of their problem-solving activities. The results suggested that active QCs had a significantly higher level of involvement from the middle management than had inactive QCs. Active QCs had more circle members and had a significantly higher attendance rate at QC meetings than had inactive QCs. Further, active QCs had a significantly lower rate of failure in their problem-solving process than had inactive QCs. Moreover, it was also found that for active QCs, their QC tenure was negatively correlated with the QC size, and was positively correlated with the number of projects attempted, the number of projects dropped, and the number of projects completed. For inactive QCs, the attendance rate at QC meetings was negatively correlated with the number of projects completed and their QC tenure was negatively correlated with the rate of failure.

The Survival of Quality Circles: An Examination of the Major In-Process Differences Between Active and Inactive Quality Circles

Japanese management practices have attracted a lot of attention in the United States (e.g., Hatvany & Pucik, 1981; Ouchi, 1981; Pascale & Athos, 1981; Takeuchi, 1981). Moreover, quality circles (QCs), in particular, have been considered as one of the most promising approaches to improving American workers' productivity (e.g., Blocker & Overgaard, 1982; Gryna, 1981). It was estimated that over 90% of the Fortune "500" companies now have QC programs in their structures (Lawler & Mohrman, 1985) and over two hundred thousand American workers have been in QCs (Lawler, 1986). Many well-regarded, large companies, such as IBM, TRW, Honeywell, Westinghouse, Digital Equipment, and Xerox use them a lot.

A quality circle (QC) is a group of employees "who usually meet for an hour each week to discuss their quality problems, investigate causes, recommend solutions and take corrective actions when authority is in their purview" (Reiker, 1983, p. 1). Recently, Gibson (1981), Orfan (1981), Thompson (1980), and Tollison (1986a, 1986b) suggested that distinctions should be made between "in-process" and "end-product" goals. Tollison (1986b) stated that the "end-product" measures are "macroscopic." More specifically, end-product goals are defined in terms of the ultimate benefits to the employee and the organization (Orfan, 1981). As such, predominant end-product goals include cost savings, improved product quality, safety, high productivity, high job satisfaction and quality of work life, and low absenteeism and turnover. These goals contribute to the overall success of the organization in a competitive market. In other words, the effect of quality circles on the "effectiveness" and "efficiency" of the whole organization is examined. According to Steers (1984), "effectiveness is the

extent to which operative goals can be attained, efficiency is the cost/benefit ratio incurred in the pursuit of these goals" (p. 22).

In the literature, most studies examined the end-product goals of quality circles. For example, many studies examined the effects of employee participation in QC programs on employees' quality of work life, productivity, absenteeism (e.g., Marks, Mirvis, Hackett, & Grady, 1986), employees' perceptions of the influence on their jobs, the characteristics of their jobs, overall job satisfaction and involvement (e.g., Cole & Tachiki, 1984; Rafaeli, 1985; Shelby & Werner, 1980; Wesley, Byrd, Anderson, & Holliman, 1986; Yager, 1981; Zemke, 1980), perceptual differences in attitudes on QCs (e.g., Berger & Holcomb, 1985; Holcomb & Berger, 1986), and employees' motivation (e.g., Yager, 1981).

On the other hand, "in-process" measures examine the inner workings of a particular quality circle program. Tollison (1986b) suggested that in-process goals "require a definition of effectiveness and a determination of the ingredients which contribute to that effectiveness" (p. 86). Thereby, the in-process goals focus on the effectiveness of quality circle operation in itself. In other words, the major purposes of studying in-process goals of quality circles are to evaluate the quality circles' problem-solving process per se and gain insights as to why quality circles have worked or failed, and how to run quality circle programs more successfully in an organization.

These goals are related to the operations and functions of the QCs and can be used for immediate feedback to management, and as a decision-making tool for improvements and modification of the administrative policies (Tollison, 1986a, 1986b). Gibson (1981) stated that critical in-process goals, whose achievement presupposes, and largely determines, end-product

success or failure of QCs are less clearly articulated. In the literature, very few studies examined the in-process goals of quality circles (cf. Keefe & Kraus, 1982).

Cole and Tachiki (1983) suggested that QC activity in Japanese chemical industries has declined significantly over the years. Goodman (1983) expressed an important concern that very little effort has been given to the problems of maintaining a program over time. Tang, Tollison, and Whiteside (1986, 1987) and Tollison, Tang, and Whiteside (1986) also suggested that more research is needed to examine the variables related to the survival of QCs in an organization.

The major purpose of the present study was to examine the major "in-process" differences between active QCs and inactive QCs in a quasi-experimental field study. Inactive QCs were operationally defined as QCs that were no longer in operation. As such, no member wanted to continue QC's problem-solving activities and no manager in that specific area had interests in and support for that quality circle. In the present study, "effectiveness" variables of active and inactive QCs were examined (cf. Steers, 1984, p. 22). We hope that the present study will be able to provide more "information on 'better' QC implementation strategies" and to contribute to "our ability to delineate the various variables having to do with success and failure of QC programs" (cf. Rafaeli, 1985, p. 614).

It has been suggested that management support is very critical to the success of QCs (e.g., Cole & Tachiki, 1983; Gibson, 1981; Goodman, 1983; Ingle, 1982; Reiker, 1983). Concern for employees or management support has significant impacts on the behavior of groups (e.g., Argyris, 1964; Herzberg, 1966; Likert, 1967; McGregor, 1960; Roethlisberger & Dickson, 1939). Latham and Saari (1979) exmained the importance of supportive relationships in goal

setting and found that supportive behavior resulted in higher goals being set than did nonsupportive behavior. Lawler and Mohrman (1985) also suggested that resistance by "middle management" is one of those many destructive forces related to QCs' failure (p. 68).

In the present study, "middle-management involvement" was examined. Middle-management involvement was operationally defined as the number of times middle-level managers were requested to attend quality circle meetings. It is reasoned that if middle-level managers attend QC meetings, they will be able to offer their knowledge, information, expertise, and resources to those QCs and help them select, coordinate, and solve QC problems. It is plausible that without sufficient involvement, support, or help from middle-level managers, these QCs probably will not be able to function effectively and/or efficiently and will not be able to survive.

Based on the fact that resistance by middle management is one of the destructive forces related to QCs' failure and the above suggestions, the present authors predicted that the lack of middle-management involvement would have a significant impact on the survival of QCs. Thus, hypothesis one was tested as follows:

H1: Active QCs would have a higher level of middle-level management involvement than would inactive QCs.

Dean (1985) pointed out that QC members "apparently have little patience for merely going through the motions--they want results" (p. 326). Further, the primarily interest in becoming a member of a QC and attending QC meetings is probably due to "the circles' potential for improving the work place" (p. 326). This goal can be achieved by QC members, if they are able to solve problems. In the present study, QCs' problem-solving activities were

examined. According to Lawler and Mohrman (1985), inability to learn group-process and problem-solving skills, disagreement on problems, lack of knowledge of operations, and poor presentation and suggestions because of limited knowledge may also lead to QCs' failure. It is reasonable to believe that if these problems exist in QCs, these QCs probably will experience a very high rate of failure in solving their problems.

One of the most frequently given reasons for failure to join a QC is the perception that QCs do not accomplish much (Dean, 1985). One factor related to this perception is "the success or failure of previous programs" (Dean, 1985, p. 325). Wayne, Griffin, and Bateman (1986) also stated that "if a QC never has a suggestion adopted, the members will become discouraged, and even disband" (p. 84). In a recent study of QCs, Brockner and Hess (1986) found that the unsuccessful QCs tended to have members with significantly lower self-esteem than did the successful QCs. It appears that the lack of accomplishment, lack of high self-esteem among members of the unsuccessful QCs, the discouragement, failure, and the possible disbandment of QCs are somewhat related, although the causal relationships among these variables have not been determined. Following this line of reasoning, it is reasonable to believe that should QCs have a significantly higher rate of failure, these QCs would be destroyed and become inactive. Thus, hypothesis two was tested as follows:

H2: Active QCs would have a significantly lower rate of failure in their problem-solving activities than would inactive QCs.

With a high rate of failure in solving their problems, QC members "may not expect the QC to be effective" (Dean, 1985, p. 325). Marks et al. (1986) pointed out that an important asset of QC membership was that QCs were "sources of both informational and emotional social support" (p. 68). If QC

members are not satisfied with their QC-related activities, they probably will reduce and withdraw their involvement in QCs.

Further, "low volunteer rate" was also suggested by Lawler and Mohrman (1985) as one of the destructive forces for QCs. It should be pointed out that in the U.S., QC membership is usually voluntary in most organizations. The QC programs offer an enlightened philosophy of employee participation in and identification with the organization (Wesley et al., 1986). Dean (1985) also found that the desire for greater involvement in the organization and a belief that QCs will be instrumental in solving problems of quality, productivity, and working conditions relate significantly to an individual's decision to join a circle. Further, Lawler and Mohrman (1985) and Sims and Dean (1985) also considered self-managing work teams the logical extension of quality circles. Sims and Dean (1985) suggested that in self-managing teams, "all work group members are also team members" (p. 28). Similar concerns were also expressed by Kanter (1983). It appears that one possible trend in managing participation is to get more people involved. It was plausible that a high level of participation might be related to a high level of overall success and that some QCs failed to survive because they did not have enough members in QCs.

Recently, Brockner and Hess (1986) examined the differences between successful and unsuccessful QCs. In their study, a QC was designated as relatively successful if it had generated at least two solutions to problems that upper level management actually accepted and implemented. Brockner and Hess (1986) found that size was not significantly larger for successful QCs compared to unsuccessful ones.

In their study, only nine QCs were examined in a 12-month period. Due to the short duration of their study, the lack of successful problem-solving

activities in these unsuccessful QCs might have not yet caused the disbandment of their QCs. It is plausible that in the long run, a high rate of failure may lead these QCs to their inactive status in an organization.

Moreover, according to the intrinsic motivation literature, the amount of time an individual spends on the target activity during the free-choice period (e.g., Deci, 1971; Lepper, Greene, & Nisbett, 1973; Tang, 1985, 1986, 1987; Tang & Baumeister, 1984; Tang, Liu, & Vermillion, in press; Shalley & Oldham, 1985) and his or her willingness to participate in future experiments (cf. Amabile, DeJong, & Lepper, 1976; Staw, Calder, Hess, & Sandelands, 1980) are considered different measures of intrinsic motivation. In the U.S., QC membership is mostly voluntary (or intrinsic). It was reasoned that QC members who were interested (intrinsically and/or extrinsically) in QC activities would attend QC meetings more than those who were not interested. It was plausible that some QCs failed to survive because there were not enough members in QC meetings. It was also believed that QCs would not be able to function effectively and solve their problems if the attendance rates at QC meetings were low. Thus, the present authors hypothesized that active QCs would have a higher attendance rate at QC meetings and have more QC members than would inactive QCs.

H3: Active QCs would have a higher attendance rate at QC meetings than would inactive QCs.

H4: Active QCs would have more members (i.e., large QC size/membership) than would inactive QCs.

Ferris and Wagner (1985) also stressed that "the effects of group size on QC performance deserve researcher's attention" (p. 158). It was also the interest of the present study to examine QC membership during the first three months and the last three months of QCs' operations. An important question

one may ask is: Is there a change over time in the QC membership (size), and is this a harbinger of success or failure? Since manager's lack of participation in problem-solving and low volunteer rate were two of the many destructive forces related to QCs' failures (Lawler, 1986; Lawler & Mohrman, 1985), thus, it stands to reason that QCs' members would withdraw themselves from QC activities and QC size would drop significantly towards the end of inactive QCs' operations. For active QCs, we did not expect to have any significant changes in terms of QC size at the end of the third year. The present authors predicted that inactive QCs probably would experience a significant drop in terms of their QC membership before the total disbandment of their QCs, whereas active QCs would not. It was expected that these analyses of QC membership over time would provide information with theoretical and practical importance.

Method

Subjects

Subjects of the present study were 316 employees (6.8% of the total work force) of a middle Tennessee structures fabrication and assembly plant. These employees were involved in 53 QCs over a three year period. The average age of employees involved in QCs was 36.8 years. QC members' educational level varied from grade school to graduate degrees with an average of 13.12 years of school. The average tenure of QC members with the company was 6 years. The range of circle size varies from 3 to 26 members with an average of 8.5 members per circle over the three-year period.

Of the 53 QCs, 17 QCs died during the three-year period. These 17 QCs were labeled as inactive QCs, whereas the other 36 were labled as active QCs. The criteria for deciding that a group has become inactive are described as follows: First, the facilitator of the QC interviewed all QC members

concerning their willingness to continue the QC operation. As long as there was one QC member who wanted to continue to solve his/her QC-related problems, the QC was still considered "active". If, for one reason or another, QC members did not want to participate in solving QC-related problems for a certain amount of time, then, this QC was considered as just "resting". During this resting period, the number of members in QC (QC membership/size) was recorded as if the QC was active. The facilitator would try to revive this type of QCs. Second, the facilitator also interviewed the managers in the specific area where the QC existed in order to determine their interests in and support for this particular QC. If none of the QC members wanted to have a QC and managers did not have interests in and support for the QC, then, this QC was pronounced "inactive" (or dead). In the three year period, none of our QCs was pronounced "inactive" and then became "active" again. Thus, the death rate for inactive QCs was 100%. In other words, an "inactive" QC was considered as the total disbandment of the team and QC members were no longer there.

Dependent Variables

In the present study, middle-level managers' attendance at QC meetings was examined. It is obvious that middle-level managers' attendance does not equal management support. However, as discussed in introduction, the attendance of management personnel at QC meetings has the potential to influence the effectiveness and/or efficiency of QCs in an organization. Further, this type of data and other related variables examined in this study were measurable, quantifiable, objective, and can be retrived from archival data (sources) of QC programs.

In the present investigation, middle-management involvement was operationally defined as the middle-level managers' invited attendance at QC

meetings. These records were drawn from QC minutes. Since those appearances occured on an ad hoc basis, such appearances were tallied by the number of occurences rather than as a percentage. It should be pointed out that middle-level managers were not required to attend QC meetings. They did so only when they were invited to attend. Thus, the number of occurence would be the appropriate unit of analysis, since the attendance rate of middle-level managers would approach 100% for most of QCs in the organization. Further, QC tenure would be expected to correlate with the occurence of invited attendance, thus, a separate analysis of covariance using QC tenure as a covariate was conducted. Included in the tally of middle-management involvement were general supervisors, superintendents, managers, directors, vice presidents, industrial engineers, safety engineers, supervisors from other areas, and technical support personnel.

QC members' attendance rate at QC meetings was also obtained from the QC minutes. Total actual hours of meetings attended across the life of the QC were divided by the total possible hours across the life of the QC to obtain an overall attendance percentage.

QC size reflected the number of members in a QC. QC size was examined by averaging the number of QC members across the life of the QC in the three year period.

During the three-year period, 28 QCs were formed in the first year, 4 of which became inactive before the end of the first year. Eighteen QCs were formed during the second year and 7 were organized during the third year. Of these 53 QCs, only 7 had survived for the whole 36 months period. Of the 7 QCs formed during the third year, none of them became inactive before the end of the third year.

Further, QC size (QC membership) for the first three months of each QC

was also recorded. Moreover, QC size for the last three months of QC operations was also collected. That is, for active QCs, data from October through December of the third year were collected, whereas for inactive QCs, QC membership from the last three months of their operation (before the total disbandment of the circle) was also examined. Therefore, the real time periods for inactive QCs were all different and were scattered around during the first two-year period, since no QCs became inactive during the third year. Further, QC tenure was different for most of these 53 QCs, thus, the present data analyses were conducted for the ease of data manipulation. Further, the first three time periods were labeled as Time 1, Time 2, and Time 3 and the last three time periods were labeled as Time 4, Time 5, and Time 6 in the present study. During Time 1, QC size varied from 4 to 26; during Time 6, it varied from 3 to 20.

QC facilitators' cumulative project status reports were used to examine QCs' problem-solving activities. The reports were updated monthly and reflected project starts, management presentations, projects dropped, and whether or not a project report had been filed. The number of projects attempted, the number of projects dropped, and the number of projects completed were determined by examining the facilitators' cumulative project status reports. Further, a drop out rate (i.e., rate of failure) was calculated by dividing the number of projects dropped by the number of projects attempted.

QC tenure was defined as the length of time the circle had existed in the three-year period, as expressed in manufacturing days. Manufacturing days were used in place of calendar days due to the ease of mathematical manipulation. Weekends and holidays are removed and the work days are numbered sequentially. For those inactive QCs, QC tenure was the total life

span of the circles. The active and inactive QCs were not significantly different in their QC tenure.

Results

The major purpose of the present study was to examine the in-process differences between active QCs and inactive QCs. The means and standard deviations of the dependent variables for active and inactive QCs are presented in Table 1. All the dependent variables (except QC tenure) were analyzed using a multivariate analysis of variance (MANOVA). The results of this MANOVA showed that active QCs and inactive QCs were different from each other on these variables, F (7, 45) = 3.66, p = .003, Wilks lambda = .64. Further, a MANCOVA using QC tenure as a covariate was also performed. The results showed that the same main effect was again significant, F (7, 44) = 9.02, p = .000, Wilks lambda = .41. Moreover, separate one-way ANOVAs for these dependent variables were conducted.

Insert Table 1 about here

Hypothesis one suggested that active QCs would have a higher level of middle-management involvement than would inactive QCs. The results of the present study showed that active QCs had a significantly higher level of involvement from the middle management than had inactive QCs, F (1, 51) = 7.82, p = .007, omega squared = .114. When QC tenure was controlled as a covariate, the results of an ANCOVA showed that the difference between active and inactive QCs was still significant, F (1, 50) = 5.53, p = .023. Thus, H1 was supported by the present data.

In terms of QCs' problem-solving activities, it was predicted that inactive QCs would have a significantly higher rate of failure in their

process than would active QCs. Our data suggested that inactive QCs' rate of failure, (i.e., drop out rate, the number of project dropped/the number of project attempted) was significantly higher than that of the active QCs, F (1, 51) = 7.09, p = .010, omega squared = .104. Thus, H2 was also supported by the present data. It was interesting to note that the differences between active QCs and inactive QCs on the number of QC projects attempted, the number of projects dropped, and the number of projects completed failed to reach significance.

It was predicted that active QCs would have a significantly higher attendance rate at QC meetings than would inactive QCs. The results of a one-way ANOVA showed that the difference between active and inactive QCs on members' attendance rate was significant and in the predicted direction, F (1, 51) = 4.56, p = .038, omega squared = .063. Therefore, H3 was also supported.

The results of the present data suggested that active QCs had more members (i.e., a larger QC size) than had inactive QCs, F (1, 51) = 5.38, p = .024, omega squared = .076. Hypothesis four was supported by the present data.

It was also the interests of the present study to examine the differences between active and inactive QCs concerning QC size over time. The data on QC size were examined in a mixed design with one between-subjects variable (active vs. inactive) and two within-subjects variables. The difference of QC size between the first three-month period and the last three-month period was examined and treated as one within-subjects variable. Further, the first, second, and the third month during each time period were treated as the second within-subjects variable.

The results of this mixed design showed that active QCs tended to have

more members (i.e., larger QC size) (M = 10.15) than inactive QCs (M = 7.96), F (1, 51) = 6.42, p = .014. QCs, active and inactive QCs combined, tended to have more members during the first three months of their operation (M = 11.26) than the last three months of their operation (M = 8.09), F (1, 51) = 36.79, $p < .001$. There was no significant differences among the three months in terms of QC size, F (2, 102) = 2.33, p = .102. The interaction effects failed to reach significance. The means of QC size for active and inactive QCs during these six time periods are presented in Table 2.

Insert Table 2 about here

Further, simple main-effects test for each time period showed that active QCs tended to have more members (i.e., larger QC size) than inactive QCs at Time 1, F (1, 51) = 4.67, p = .035; Time 2, F (1, 51) = 6.31, p = .015; Time 3, F (1, 51) = 6.30, p = .015; and Time 6, (1, 51) = 4.76, p = .034. However, the differences at Time 4 and Time 5 were not significant.

It was also suggested from the present data that for active QCs there was no significant difference on QC size between Time 5 and Time 6, F (1, 35) = .00, p = 1.00; whereas for inactive QCs there was a significant change in QC size between Time 5 and Time 6, F (1, 16) = 9.99, p = .006.

Pearson product-moment correlations among variables are presented in Table 3. Correlations above the diagonal are for active QCs and below the diagonal are for inactive QCs. The correlational patterns between active and inactive QCs were examined. These correlational differences would enable us to have a better understanding of the major differences between active and inactive QCs. Table 3 showed that for active QCs, middle-management involvement was significantly correlated with QC tenure, the number of

projects attempted, the number of projects dropped, and the number of projects completed. For inactive QCs, middle-management involvement was only related to tenure.

Insert Table 3 about here

For active QCs, the tenure was negatively correlated with the QC size (membership). However, for inactive QCs, the same correlation was not significant. For active QCs, QC tenure was correlated with the number of projects attempted, the number of projects dropped, and the number of projects completed. Again, the same correlations were not significant for inactive QCs.

For inactive QCs, members' attendance rate at QC meetings was negatively correlated with the number of projects completed. This was not true for active QCs. Further, for inactive QCs, their tenure was negatively correlated with the drop out rate, whereas for active QCs, the same correlation was not significant. For active QCs, the more project they dropped, the more project they completed, whereas for inactive QCs, the same correlation was not significant.

Discussion

The results of the present study showed that active QCs had a significantly higher amount of involvement from middle management than had inactive QCs. It is possible that middle-level managers have participated more in active QCs' problem-solving activities and have offered more support than they have done to inactive QCs. Therefore, the lack of middle-management involvement may have killed these inactive QCs. However, it should be pointed out that the middle-management involvement measure in the

present study reflects the number of times that middle-level managers are invited to QCs. Therefore, if QCs are not very active and are not making progress in their problem-solving activities, then, it is possible that middle-level managers are not invited to their QCs. It can be argued that these managerial behaviors may themselves be a product of QC performance and not necessarily a cause of it. The results of the present study further support the notion that management involvement or support is very critical to the success of QCs (e.g., Cole & Tachiki, 1983; Gibson, 1981; Goodman, 1983; Ingle, 1982; Reiker, 1983).

It was also pointed out in the present study that active QCs had more members and a higher attendance rate at QC meetings than had inactive QCs in the three-year period. Further, our data also showed that active QCs had more members than inactive QCs in the very first month of their operation. There was a decreasing trend of QC membership when the first three months were compared with the last three months. It was also interesting to note that there was no significant difference between active and inactive QCs during Time 4 and Time 5. During Time 6, inactive QCs experienced a significant drop of their QC membership before the total disbandment of QCs.

Based on these data, it appears that the bigger the QCs, the better the chance of survival. It is reasonable to believe that people participate in QC meetings and solve QC-related problems with different intrinsic and extrinsic reasons. Marks et al. (1986) also stated that although QCs are directed toward solving job-related quality problems, "QC activities are expected to lead also to improved working conditions and greater opportunities for expression and self-development for participating employees" (p. 61). It is possible that members in active QCs are able to satisfy these needs in QC activities. On the other hand, inactive QCs failed

to survive because of the lack of QC membership and low attendance rate which were probably caused by the fact that QCs were unable to satisfy their needs and QCs were not instrumental in solving their problems. It is also possible that active QC members are more interested in problem-solving activities than inactive QC members, therefore, active QC members form a larger group in the beginning of their operation than inactive QC members.

Further, a significant drop of membership is probably a sign of "possible failure" in the near future. Thus, timely support from management to revive these troublesome QCs is very critical to the survival of QCs.

It was also found that for inactive QCs, a high attendance rate at QC meetings was negatively correlated with QCs' "effectiveness", i.e., the number of projects completed (cf. Steers, 1984). However, for active QCs, the same correlation was not significant. Several possible reasons are offered as follows: First, when a large number of members participate in QC meetings, it is possible that members in inactive QCs are unable to concentrate on the problem, to agree with each other on the priority of the problems, the problem itself, or the solutions to the problem. In other words, QCs' "inability to learn group-process and problem-solving skills" is one of the possible reasons for inactive QCs' failure (cf. Lawler & Mohrman, 1985). Second, it is also possible that many QC members in inactive QCs are involved in social loafing (cf. Harkins & Petty, 1982; Latané, 1981; Latané, Williams, & Harkins, 1979). Finally, members in inactive QCs may have lower intrinsic and/or extrinsic interests in problem-solving activities than those in active QCs.

Steiner (1972) proposed that member effort tends to decline with increasing group size, presumably because of reduced feelings of personal responsibility. However, the results of the present study showed that active

QCs had significantly more members than had inactive QCs. Therefore, it appears that QC size is an important factor to the survival of QCs. If the QC size (membership) drops down to a certain level, it may give QC members a feeling that people in this area are not interested in solving QC-related problems, or the problems in this area can not be solved by QCs. It is possible that members in those areas do not believe that QCs are instrumental in solving problems, thus, they do not want to join QCs (cf. Dean, 1985). If too few members are interested in QCs, they can not solve these problems very effectively. They finally give up. Thus, both the low attendance rate at QC meetings and the lack of QC members may kill a QC. It appears that QC size may have different impacts on member effort and the survival of the group.

On the other hand, our data further suggested that QC tenure was negatively correlated with QC size for active QCs. This significant correlation may have revealed the possibility that over the years, active QCs are able to weed out some QC members who do not actively participate in or contribute to QCs' problem-solving activities, whereas inactive QCs are not.

In terms of QCs' problem-solving activities, we found that there were no differences between active and inactive QCs on the number of QC projects attempted, the number of projects dropped, and the number of projects completed. However, active QCs had a significantly lower rate of failure (dropped/attempted) than had inactive QCs. Further, for inactive QCs, QC tenure was negatively correlated with drop out rate. It appears that those QCs with a short life span may have a high drop out rate. Therefore, it is possible that a high rate of problem-solving failure (drop out rate) in the beginning of QCs' operations is related to the survival of QCs. These results may again reflect the points mentioned by Dean (1985) concerning members' decision to join a QC. That is, if QCs have a high rate of failure,

then QC members will quit their problem-solving activities because QCs are not instrumental to solve problems. It is plausible that the appropriate use of middle-level managers' support and expertise in the problem-solving process may help QCs select the right project to work on in the first place. Further support or involvement from middle-management personnel will also help QCs collect all necessary information and resources to solve the problem. Therefore, it appears that middle-level managers' support on QC problem identification, problem selection, and their effort in providing all necessary information and resources to solve QCs' problems are very critical to the survival of QCs.

It was also found that for active QCs, middle-management involvement was related to the number of projects attempted and the number of projects completed, however, for inactive QCs, these correlations were not significant. Thus, for active QCs, middle-management involvement is related to the QCs' accomplishments and achievements, whereas for inactive QCs, middle-management involvement is not related to their accomplishments. This may also reflect the point mentioned earlier in that management personnel's behaviors may themselves be a product of QC performance.

For active QCs, tenure was associated with the number of projects attempted, the number of projects dropped, and the number of projects completed, whereas for inactive QCs, these correlations failed to reach significance. It appears that active QCs are able to have a sense of accomplishment over the years, but inactive QCs are not.

It should be pointed out that dropping a project is not necessarily bad. There are several reasons for dropping a project. Sometimes, a specific project is already being taken care of by the management, is being worked on by other people in the organization, or is being put on hold by the

management, or is unsolvable by QCs at a particular time because of other related or unrelated problems, then, QCs may drop this project. In some other cases, the management is not willing to spend or invest a large amount of money to buy equipment, tools, and hire more personnel in order to solve the problem, then QCs may also drop a project. For active QCs, they are able to drop a project and then work on a new one. A significant correlation between the number of projects dropped and the number of projects completed was found for active QCs but was not found for inactive QCs. Therefore, it is possible that active QCs are able to drop some tough or unsolvable projects and then move on and solve the new project more effectively. It is reasonable to believe that as discussed earlier, middle-management involvement is extremely important to QC's survival, QCs with a high rate of failure, in particular. When a QC drops a project, QC members may feel that their QC is not instrumental in solving problems. Without proper support from middle-level managers, QC members probably will not be able to select the "right" problem to work on. It is plausible that these QCs may fall into the trap of the self-fulfilling prophecy and fail again which may lead to the death of a QC, if timely support is not offered. It is suggested that area managers and supervisors should step in and offer their support and try to revive these QCs before it is too late. It appears that a training program for problem-solving skills is called for, especially for those QCs that have a high rate of failure in their problem-solving process early in their operations.

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Table 1

Means and Standard Deviations of Variables for Active and Inactive QCs

Variable	Active QCs		Inactive QCs	
	M	SD	M	SD
1. Middle Management Support (No.)	26.22	19.52	11.94	11.23
2. Attendance Rate at QC Meetings (%)	82.89	6.87	77.55	11.27
3. QC Size (Membership)	10.10	2.93	8.12	2.84
4. No. of Projects Attempted	4.89	2.96	4.35	3.72
5. No. of Projects Dropped	1.06	.83	1.65	1.84
6. No. of Projects Completed	2.83	2.54	2.53	3.04
7. Rate (Dropped/ Attempted)	.21	.18	.40	.34
8. QC Tenure	408.44	200.76	317.88	225.81

Note. N = 36 for active QCs and N = 17 for inactive QCs.

Table 2

QC Size for Active and Inactive QCs in the First Three-Month Period and the Last Three-Month Period

	The First Three-Month Period			The Last Three-Month Period		
QC Status	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6
Active QCs						
Mean	12.11	12.33	12.08	8.97	8.69	8.69
Standard Deviation	4.49	4.33	4.36	3.46	4.27	4.45
Inactive QCs						
Mean	9.53	9.35	9.06	7.00	6.82	6.00
Standard Deviation	2.90	3.28	3.44	3.54	3.81	3.59

Note. N = 36 for active QCs and N = 17 for inactive QCs.

Table 3

Correlations Among Variables for Active and Inactive QCs

Variable	1	2	3	4	5	6	7	8
1. Middle Support		08	-08	53***	44**	52***	02	66***
2. Attendance Rate	22		20	-01	-05	-04	02	-18
3. QC Size	22	39		-06	06	-24	21	-28*
4. Attempted	23	-40	11		56***	89***	06	81***
5. Dropped	10	-17	29	67**		36*	75***	55***
6. Completed	12	-43*	01	82***	21		-15	81***
7. Rate	-29	18	38	-07	46*	-26		02
8. QC Tenure	75***	02	-07	10	-19	08	-47*	

Note. All decimals have been omitted for correlations. Correlations above the diagonal are for active QCs (N = 36) and below the diagonal are for inactive QCs (N = 17). *p < .05, **p < .01, ***p < .001.